

Place to Blast-Rocked South Amboy

THE NEW YORK TIMES

The Dead, Missing and Injured

TOWN WILL OFFER ITS THANKS TODAY

Where Churches Are Wrecked
Lawns Will Serve Worshipers
—School Year May Be Ended

Following is the latest list of the dead, missing and hospitalized injured in Friday night's explosion:

The Dead

CINELLI, FRANK, 23, 15 Baldwin Avenue, Jersey City, operations. Killed in the loading operations.
SKYERD, 214 Carroll Avenue, Brooklyn, head and neck injuries.
NORTH, DOROTHY, 307 Smith Street, Perth Amboy, N. J., lacerations and shock.
PETERSON, CARL, 62, 230 Flatbush Avenue, Brooklyn, head and neck injuries.
PETERSON, ELIZABETH, 40, 90 Smith Street, Perth Amboy, N. J., lacerated.
A man wearing the uniform of a United States Coast Guard.

Missing

DISASTER

Hospitals Filled Ambulances, Apparatus Raced To Stricken

South Amboy, N. J., May 19 (U.P.). — Four barges blew up with night, injuring scores of persons, shattering windows for miles, knocking out a power plant and crippling communications in this waterfront town of 8000.

Mayor John D. Leonard said at least four persons were dead. Estimates of injured ranged from 150 to 300. One hospital alone treated more than 125 persons.

City Councilman William E. O'Leary, in charge of the fire department, said there were 300 known injured.

Perth Amboy General Hospital treated more than 125 persons.

AMBOY—From Page 1

South Amboy Appears Like a Battlefield

of another dripping, down the stairs and out into the middle of the street. Later, remember any of it.

OPERATIONS RESEARCH OFFICE
The Johns Hopkins University
Fort Lesley J. McNair
Washington 25, D. C.

of store row and he
Many realize the minute.
his hand place his hand
feel a wet, sticky ooze. Glass falling plaster were what got most of them.

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'Live' Mines Peril Amboy As Blast Toll Is Put at 26

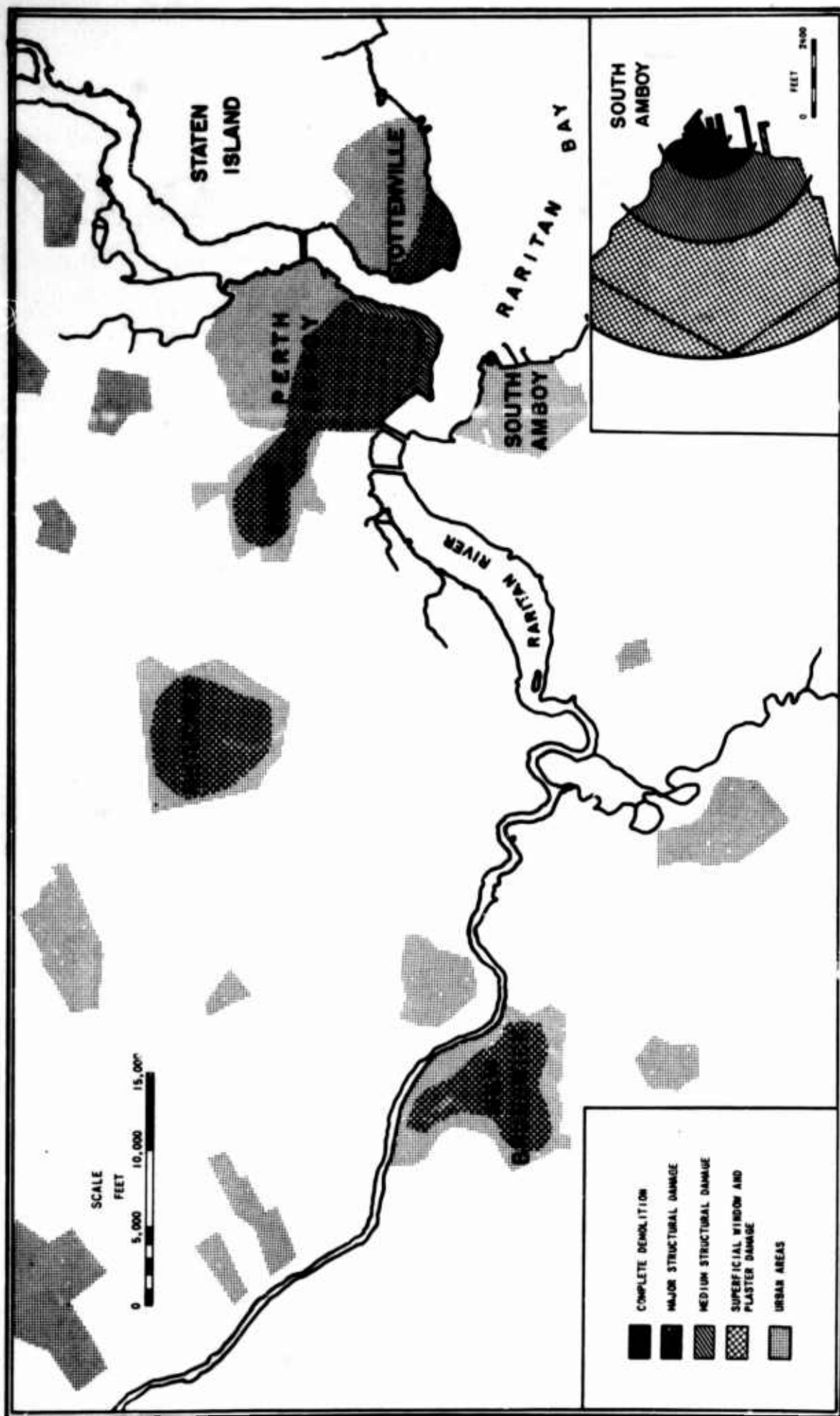
U. S. to Investigate Proper Licensing Of Arms Reported On Way to Pakistan

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The Conclusions and Recommendations of this Report are those of the Operations Research Office. No official approval of the Department of the Army, express or implied, should be inferred.



The damage caused by the South Amboy explosion to adjacent urban areas was impressive in the extent and the distance over which it was inflicted.

THE SOUTH AMBOY DISASTER

A Special Report

by

J. B. Green and Leonard Logan

7 August 1950

**OPERATIONS RESEARCH OFFICE
The Johns Hopkins University
Fort Lesley J. McNair
Washington 25, D. C.**



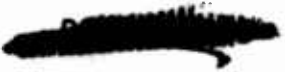
Foreword

The Operations Research Office is studying the effects of atomic explosions for the Department of the Army which is one of several agencies having interest and responsibility in protecting American cities against A-bomb attack. The primary interest of this Office is the reactions of military personnel to atomic explosions, and our analysis of the South Amboy explosion was designed from this point of view. However, certain aspects of the South Amboy disaster appear quite important from the general point of view of civilian defense.

This study both of actual effects on civilian populations and possible effects on military personnel is offered in the hope that it may be useful to agencies now actively engaged in such studies and that it may serve as a stimulus to produce much needed action to protect American community life against the threat of atomic explosions.

At the present state of research, when analysis is still tentative, it is believed that a good job of reporting is important so as to make data available for further work without prejudice to later developments or to predilections of variant purposes of research.

Dr. Ellis A. Johnson
Director, Operations Research Office





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The South Amboy Explosion and an A-Bomb

A COMPARISON

One atomic bomb would damage an area 100 times larger and cause a loss of life 1,000 times greater than was caused by the South Amboy explosion of May, 1950. Yet the significant lessons to be drawn from such peacetime disasters of much smaller magnitude than an atomic explosion may save many lives in the event that A-bombs are used in a future war.

The rapidity with which pre-disaster planning enabled local authorities to establish control in South Amboy and nearby communities and the general absence of hysteria in the community is weighty evidence that the chaotic aftermath of an A-bomb explosion could be brought under control quickly by intelligent and comprehensive preparedness.

FORMULA FOR PROTECTION

The tragedy at South Amboy is another in a long list of disasters demonstrating that control is possible only if the following has been accomplished beforehand:

1. Detailed studies and plans formulated;
2. An effective organization with adequate equipment established;
3. Continued education of populace and officials initiated;

Methods for assuming absolute control by authorities of all media of communication (police and military communications, commercial broadcasting, mobile and portable public address systems) immediately following the disaster provided.

THE EFFECT OF MILITARY TRAINING

The self-discipline displayed by ex-servicemen residing in South Amboy indicated that their military training had conditioned them against panic, possibly even against the hysteria that could be engendered by an A-bomb attack.

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Introduction

The news of an explosion at South Amboy, New Jersey, was broadcast over the radio at about 2000 hours on 19 May, 1950. First accounts of the disaster were greatly exaggerated, both with respect to loss of life and damage to property: even the newspaper accounts of the next morning editions told of the explosion of 600 tons of ammunition, loss of over 100 lives, injury to over 1000 people, and damage to property exceeding \$20,000,000.

Three days of careful investigation determined that only the equivalent of 25 to 30 tons of TNT had exploded, that 31 people died, that about 300 had been injured (only about 10 seriously), and that damage to property was considerably less than the earlier estimate.

However, the disaster must be regarded as a major one and worthy of study because of the possible application of its many aspects to the much greater effects of an atomic bomb detonated over a US city. The staff of the Operations Research Office and other organizations were quick to realize that there was an opportunity to study the reactions of a populace under disaster conditions which some people had believed, at first, were caused by an atomic bomb.

True, compared with an atomic-bomb explosion, the South Amboy blast was a small-scale affair. An atomic bomb would have destroyed an area 100 times as large and the loss of life probably would have been 1,000 times greater. Nevertheless, it was important to study the reactions of the people at first hand to learn of any behavior patterns that could be extrapolated to a situation which might have existed if an atomic bomb had exploded.

The results of this study are important to the Army for two reasons; first, because such a study might give insight into the civilian behavior in the zone of the interior; and second, because the study of special groups of civilians might forecast the reaction of military groups under atomic attack. However, critical examination

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of many disasters of all kinds will be needed before definitive conclusions can be supported by adequate data.

It is the purpose of this report to present evidence gathered by the authors at the scene of the disaster through interviews of officials and inhabitants. The authors are indebted to Colonel Schoeffel, Superintendent of the New Jersey State Police, for his assistance in obtaining easy access to these sources.

Finally, the evidence is studied from the standpoint of the Army's needs. We believe there are some lessons to be learned from this study that can be of value in future disasters and recommendations are offered accordingly.

The importance of training civilian populations is evidenced. In the case of South Amboy and nearby communities, there is a fairly stable population which has experienced several explosions in the past, beginning with the "Black Tom" in 1916. Over a period of years, the people have realized the necessity of being prepared for a possible interruption of their normal mode of life and have developed the means for rapid control of situations that, in other communities, might easily lead to disruption.

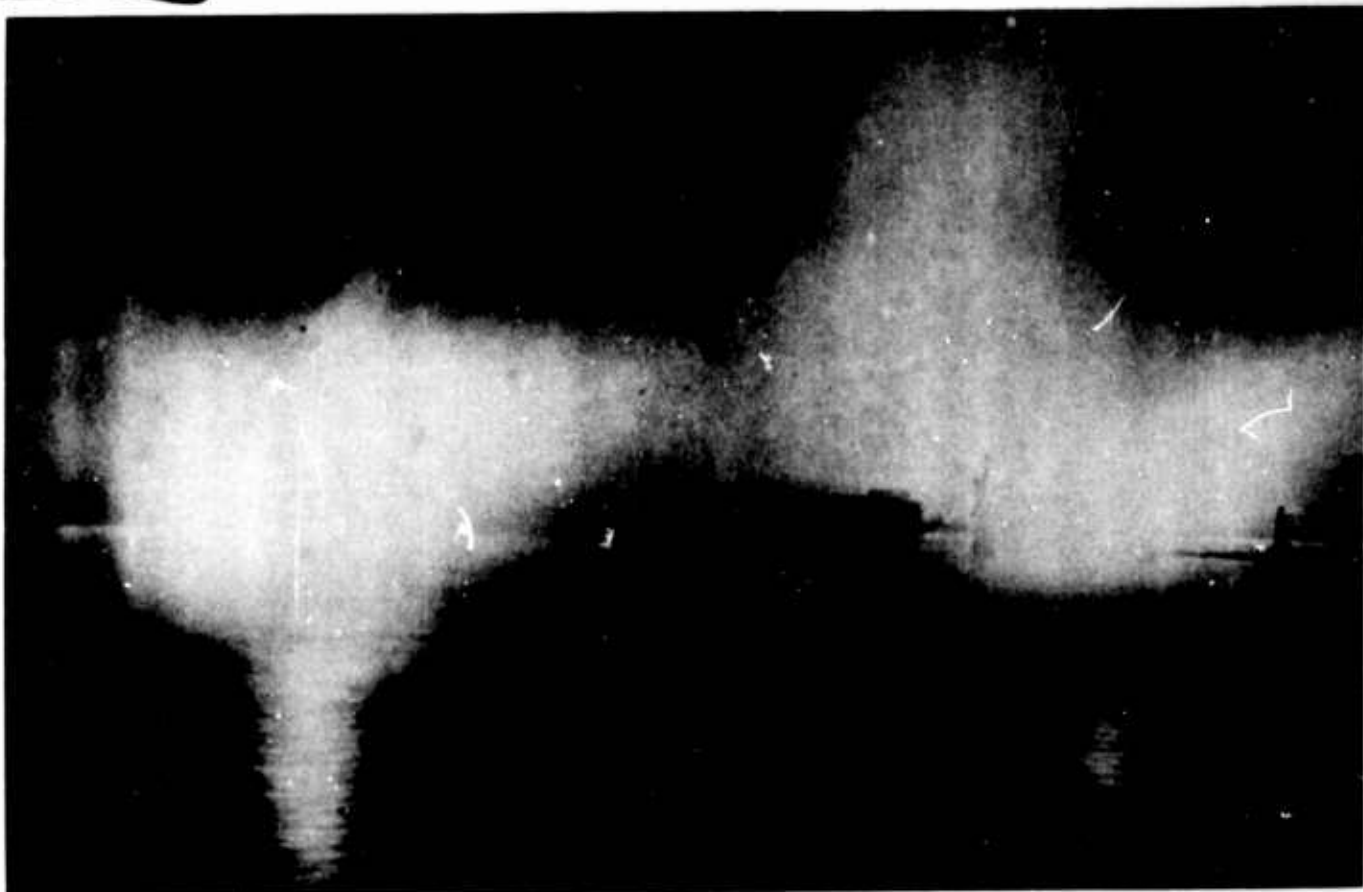
For example, the police have plans of operation for any city area involved in a disaster. Disaster committees have been established to handle various other problems that arise, such as first aid, hospitalization for the seriously injured, shelter for the temporarily homeless, special problems of infant care, provision of canteens, et cetera. All of these groups functioned quickly and effectively in the recent South Amboy disaster.

It is hoped that this study may serve as a basis for formulating a methodology for the investigation of disasters and that it may assist civilian defense authorities in their preparation for future catastrophies.

THE COMMUNITY

South Amboy, New Jersey

South Amboy, located on the south bank of the Raritan River not far from where it flows into the Atlantic Ocean, includes an area of approximately one square mile in which there is an estimated population of 8,000 composed of second- and third-generation Irish with more recent layers of Czechs, Hungarians, Italians, and Poles. Most of the people are semiskilled and unskilled workers; hence the average family income is somewhat below that of most US cities.



A spectacular blaze illuminated the waterfront as two munition-laden barges burned in the aftermath of the explosion.—Photo by Wide World.



Here is what is left of the Pennsylvania Railroad along the dock area in South Amboy after the explosion.—Photo by Wide World.

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Left: Smudged and slightly cut, Janette Neilson appears somewhat disgusted that her supper was interrupted as she peers from one of the shattered windows of her home.—Photo by Wide World.



Above: A nurse in Perth Amboy General Hospital administers aid to one of the victims of the explosion. In other beds are additional casualties of the blast.

—Photo by Wide World.

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The community, although located in New York City's metropolitan area, resembles a rural community psychologically because it is socially isolated. This social isolation is voluntary in that the people prefer to remain aloof and are reserved and indifferent to outsiders.

After the explosion they accepted strangers as a matter of course, which point might well be noticed here. It is reasonable to assume that the people of a community, disorganized by an enemy attack, are more likely to tolerate outsiders than they would under normal conditions.

The per capita income of South Amboy is reported to be a little lower than that received by the average industrial worker in the surrounding area. There are no new housing projects in the city, and very few homes have been built since the war. The houses are mostly the typical single-family and two-family working men's residences. There was evidence of overcrowding in many of these. The town is clean in appearance but it has not been promoted by a Chamber of Commerce. Many television aerials were observed. The bars were closed on Saturday following the explosion but were permitted to re-open on Sunday.

Perth Amboy, New Jersey

Perth Amboy, located directly across the Raritan River and connected to South Amboy by two bridges, is a different type of community because of its size and its larger and more varied resources. The population of this city was approximately 48,000 during the war but now is estimated at 45,000. The social distance between the upper and lower classes is much wider in Perth Amboy than in South Amboy. The population is also more heterogeneous culturally and economically.

The higher per capita income permits the city to provide more municipal services, and its shopping center serves a wider market and offers a greater variety of goods.

The leaders of the community have recognized the importance of their city to the defense of the surrounding area. It was realized that Perth Amboy would be within the range of attack on the New York City metropolitan area by an enemy from the sea, and when the rumors of war were heard in the later 1930's, the city officials began preparing for defense and any disaster that might occur. Since the end of the war they have maintained a skeleton defense organization. Hence, when the South Amboy explosion occurred, the city was prepared.

PHYSICAL EFFECTS OF THE EXPLOSION

Here are the events leading up to the South Amboy explosion, as gleaned from various sources.

On the morning of 19 May 1950, twelve railroad freight cars were on the spur track leading to the South Amboy pier of the Pennsylvania Railroad. Of the first five moved onto the pier, two cars contained 900 cases of gelatin dynamite each, two cars contained 500 cases each of M2A4 antipersonnel mines, and one car contained 1,000 cases of M1A1 antitank mines, all to be unloaded into two self-propelled lighters of 40 tons and 97 tons. After the cars were emptied, they were shunted into a siding, and the lighters were moved to the forward end of the 600-foot pier. The remaining seven freight cars were then moved into position for unloading into two other lighters of 123 tons and 180 tons.

Each of these seven cars carried 1,000 cases of M1A1 antitank mines. Three cars had been completely unloaded, the other four partially unloaded when, at 1926 hours E. D. T., without warning, a terrific explosion occurred.



After the smoke had cleared, the following damage in the immediate neighborhood of the blast was apparent.

Only 40 feet of the 600-foot pier remained.

The four lighters and seven cars had disappeared.

Ten coal barges anchored nearby had disappeared.

Three autos about 400 feet from the end of the pier had dented roofs and were otherwise distorted, and all glass was shattered. Some of the tires were flat.

Two large mechanical coal loaders, one 800 feet and the other 1,000 feet southeast of the explosion, were so seriously damaged that they will need extensive repair to be made serviceable.

A coal-loading building about 1,200 feet southwest of the explosion suffered major structural damage. One wall and the roof it supported were down. A supporting column had been displaced.

A chimney near the coal-loading building, originally 185 feet high, had lost 54 feet of its top.

The American Agricultural Chemical Plant, about 1,200 feet west of the blast, had its corrugated iron walls torn off and the supports suffered major damage.

The Jersey Central Power and Light building, about 2,400 feet northwest, suffered only glass damage. Some of the windows on the side opposite the blast were not damaged.

A small concrete block and steel factory about 1,600 feet southeast of the blast had the steel window frames blown in.

In South Amboy the closest residences were about 1,600 feet distant from the explosion. Beginning at this distance and extending out to a radius of about 4,000 feet, heavy glass damage was suffered. At the shorter radii, much more serious damage to the large buildings or buildings (such as churches and schools) high above the street level was evident, including severe plaster damage, sash frames blown in, et cetera. At the edge of the town, and about one and a quarter miles from the explosion, the extent of window damage was down below 10 percent.

The nearest buildings in Perth Amboy were 3,000 feet north of the blast. Here, windows and sash frames along the waterfront were extensively damaged. Plate-glass windows in the town as far distant as two miles from the blast were cracked. The most serious plate-glass damage was in the shopping center located along streets at right angles to radii extending from the point of explosion. Oddly enough, a china and glassware shop, surrounded by stores with broken windows, was completely unharmed.

AFTER



1. The American Agricultural Chemical plant, A, 600 feet west of the pier, was wrecked. The Pennsylvania Railroad office, B, 400 feet west, was completely demolished. The Jersey Central Power and Light Co. building, C, 1,100 feet west by north, received window damage only.

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2. The coal-loading building located 700 feet west of the pier received major structural damage.

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3. The upper 54 feet of a 185 foot coal loading-house chimney, located about 700 feet west of the blast, was blown off.

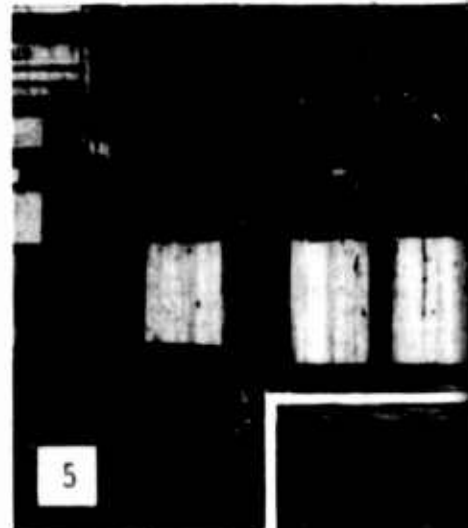
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4. The twisted and bent steel frames of the Pennsylvania Railroad coal loaders, standing 400 feet away to the southwest, give graphic evidence of the destructive force generated by the detonation.

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5 and 6. Stores and houses along Broadway in South Amboy, about 1,500 feet southwestward, suffered extensive exterior and interior damage.

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7. An attendant hazard was the many antipersonnel mines such as these "bouncing betties" that were scattered over the immediate area.

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8. The window casings in the rear of the W. G. Hoffman High School were severely damaged.

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on off.

9. The only two surviving workers in the area were sitting in one of these battered automobiles at the moment of the blast.

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10. Only 40 feet of the 600-foot pier on which stood the munition-filled freight cars remain to mark the site of the explosion.

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11. All the window frames of this small factory situated 800 feet south southwest of the detonation were blown in.



B

Tottenville, Staten Island, one and a half to two miles away from the blast, suffered a small amount of window damage. Metuchen, five miles away, Fords, four miles away, and New Brunswick, eight miles away,^{1/} received some window damage.

The earth shock was felt at much greater distances, even as far as Trenton, 35 miles away.

Missiles

Parts of exploded and unexploded M2A4 mines were scattered over a 60 degree sector of about one mile radius and whose central radius was about due west. About 200 unexploded mines were found inside the Jersey Central Power and Light building, and the main coal pile of the company was rendered unuseable because of the many mines buried within. Over 1,700 mines were found inside the arc described above, up to Sunday, 21 May. Demolition squads were continuing the search.

The engine from one of the lighters was hurled westward and landed in three pieces 400 yards, 450 yards, and 500 yards respectively from the landward end of the pier.

A piece of one of the lighter's bumpers, about four feet long, four inches wide, and one-half inch thick, was buried broadside in the brick wall of a house about 1,700 feet southwestward from the blast. Another piece was hurled into a nearby garden.

A capstan plate, 20 by 23 by 1 inches and weighing about 125 pounds, landed in a Perth Amboy street, 6,000 feet away, and buried itself partially in the sidewalk.

Mud and slime from the river bottom splattered over South Amboy to a distance of about half a mile.

Personnel Injuries

Of the thirty-three persons in the pier area, only two escaped death, both of whom were inside an auto facing away from the blast. Parts of four bodies were recovered. Twenty-five others disappeared completely.

^{1/}This distant damage may have been caused by seismic disturbances. There is some evidence that the ground shock was channeled. Father Joseph Lynch of Fordham University reports that his seismographs show the principal ground wave to have been a plane-polarized shear wave.

About 400 people were injured by flying glass and plaster. Approximately 125 victims were hospitalized, but by the following evening only 35 remained for treatment; 48 hours after the explosion there were less than 25 in the hospital.

Mirabile dictu, not a single case of injury from the several hundred missiles was reported, although conditions were just right to produce many tragic accidents, since it was a "shopping" night and all the stores were open.

At this point the account ceases to be factual, and becomes speculative. A study of the physical damage thus far described gives a rough estimate, based on the American Table of Distances, that the explosion was of a magnitude that would result from the instantaneous explosion of about 25 to 30 tons of TNT. Unfortunately, there was no simple structure such as a flagpole near enough to the blast to allow a more accurate estimate to be made.

As to the actual cause of the explosion, that will probably remain undetermined. There are no living witnesses to what happened. To propagate a high-order detonation through wooden boxes is very difficult. Yet something of this sort must have happened because seismograph records and other reliable witnesses agree that there was only one explosion; everything that exploded went off at the same time.

THE MILITARY PROBLEM

Comparison of Amboy Area With Military Zones

Although South Amboy and its sister city Perth Amboy, are civilian areas, they have several things in common with rear-echelon military establishments. They have a compact population fairly evenly distributed within an area. The population is homogeneous in that a majority of the people belong to the same social stratum, and although many racial groups are represented among them, the differences in race culture would not be greater than those found in an average group of men in the United States Army.

The outlook on life of the average civilian is likely to be similar to that of the average enlisted man because both are confined to a particular social and geographical environment. Both view things from their own standpoint rather than from the viewpoint of society as a whole or the Army as a total unit.

Army personnel and civilians have recognized leaders on whom they rely in times of emergency. Army personnel rely on their respective commanders for leadership. Civilians depend on persons they have chosen for leadership and look to them for guidance in times of disorganization and confusion. Fortunately for both South Amboy and Perth Amboy, the people of both communities had been conditioned to anticipate such an event as this explosion and had good leaders in their respective mayors who assumed complete control immediately after the explosion.



South Amboy has one characteristic in common with an Army rear echelon: both are, to a degree, socially isolated. South Amboy is socially isolated by choice; its people prefer to remain aloof, clannish, and wary of strangers. There are no signs of an organized effort through its Chamber of Commerce to proclaim its advantages to the world, although it carries on normal trade with other centers. As in the case of military personnel, there are frequent contacts with outsiders but there seems to be a minimum of social integration with the surrounding area. The general psychology of South Amboy approximates that of a rural community even though it is an urban industrial community.

There are also dissimilarities between this community and a military community. There is a wider range of ages in this civilian group than in a military organization. The family is the basic unit in the civilian community while the com-

pany, battery, or squadron are the basic units in the Army. Through necessity, the Army is more authoritarian than the civilian community while the civilian community, by nature, is more unregimented in organization and selects its own leaders through established social and legal processes.

Pre-Conditioning of People in Area to Explosions

The people living in South Amboy and the surrounding areas were not completely unprepared for this unexpected explosion. Previous similar disasters in the area had conditioned them to the possibility of such an event and, therefore, their reactions were more controlled than if the explosion had come as a completely new experience. These reactions will be discussed in another section of this report.

The preconditioning events referred to were the "Black Tom Explosion," which occurred in 1916 at Bayonne, New Jersey, a few miles away. Also on Friday, 5 October 1918, at 7:55 p.m., at nearly the same hour as the Amboy tragedy, a detonation, known as the "Morgan Explosion," occurred at the T. A. Gillespie Shell Loading Plant. This was a series of explosions, not a single big blast like the one at South Amboy. During World War II there was another explosion at Leonardo, a Naval base located a few miles away.

The factor that probably conditioned the people more than anything else was, first, the knowledge that munitions being loaded from time to time in the area constituted a constant threat to public safety, and second, frequent warning to the public of this danger by the local press. A few days prior to this latest explosion, newspaper stories advocated the loading of munitions be limited to 500 pounds at one time.

Human Reactions to the Explosion

Attention is called again to the fact that those living in the vicinity of the explosion are plain people. They are more likely to be governed in their conduct by their emotions rather than by their reason. The conclusion reached, after talking with numerous people of all ages, sex, and social status, and who may be considered a representative cross-section of the population, was that the first general reaction to the explosion was bewilderment. A few people thought an atomic bomb had exploded; their suspicion seemed to be verified by the fact that a mushroom-like cloud arose immediately after the detonation.

The bewilderment of a majority of those within range of the impact may be summed up in an expression frequently heard; "For a few minutes I was stunned, I didn't know what happened." The 300 or more persons who were hurt, of course, were concerned more with their immediate problems than with what had caused the explosion.

A large percentage of the people, at least a majority of those interviewed in Perth Amboy, thought at first something had happened within their own houses. They said, "I thought it was the furnace blew up," or "the hot water tank exploded," or "boiler blew up," or a "gas explosion."

There were more people in Perth Amboy than in South Amboy who thought the explosion had been in their houses; most of the people in South Amboy thought it was an explosion in one of the local industrial plants. They mentioned the Sun-Ray Refinery, the American Agricultural Chemical Company, the Jersey Power and Light Company's generating plant, and the National Lead Company's plant.

There were a few cases of hysteria but no general chaos or panic. At the time of the detonation there were no large assemblies of people in South Amboy and it happened at a time when the members of a considerable number of families were all at home. The first thought of many persons was concern for the welfare of absent family members and their first constructive efforts were to locate absent loved ones. The relatively few who were unable to locate their relatives were greatly distressed. Family disorganization and uncertainty rather than fear of the explosion was the primary cause of their upset state of mind. There was concern also among the uninjured as to the extent of the injuries received by members of their families and, also, among the hospitalized injured concerning the fate of others in their families.

The sound of sirens from ambulances, fire trucks, and police cars added to the mental confusion. These suggested tragedy and increased rather than lessened the tensions generated by the explosion.

There were only a few instances of persons seeking escape as a part of their first reactions to the catastrophe. These were mostly young mothers whose husbands were away from home and teen-age boys not under the immediate supervision of their parents. On the second day following the explosion there seemed to be no indications of a general permanent exodus from the community. First, there was no place for most people to go; and second, they were too strongly attached to the community by cultural and sentimental ties to leave.

A secondary stage of reaction to the explosion on the part of a considerable number was a feeling of frustration because of damage to their property. Several had just completed spring housecleaning and had repainted their homes. The paint was ruined by the black slime blown from the river. The interiors of many houses were in shambles. The interior damage to buildings was worse than their exteriors indicated, and it was discouraging to those who had spent a life-time accumulating what little they had to see their homes ruined.



Frustration was mixed with anger. This anger was not directed at any one person or group of persons, official or unofficial. The object of their anger was "they," an impersonal authority. "They ought to do something about this." "They shouldn't have let them load that stuff in that place." "They are going to have to pay for all this mess." The citizens were content to leave the details of settlement to local authorities.

There was a fear felt by some immediately after the explosion that a second or a series of detonations might follow. The older inhabitants remembered that the "Morgan Explosion" in 1918 was a series of blasts. Their fears were dissipated as soon as they learned what had happened.

The effect of a sudden catastrophic event usually can be divided into two phases: the immediate reaction and the long-time period of rehabilitation. When there is only one explosion or similar disaster, this process follows the usual pattern. This was the situation at South Amboy. However, no study was made of long-time plans the people may have for reconstruction.

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No attempt was made in the study of the effects of this explosion to determine what the reactions might have been had there been a series of explosions or had the threat of future explosions remained, such as could exist when the nation is at war. The data obtained in this study do not lend themselves to such conjectures.

It is easy to conclude, however, in a situation where the threat of disaster is constant and the occurrence of disasters is periodic, that frustrations are more likely to become acute and psychoses more widely spread until they finally graduate into a general, indifferent state of mind.

Rumors thrive in an environment of ignorance and uncertainty. Fortunately for both South Amboy and Perth Amboy these two elements were quickly eliminated through public communication and address systems. The people were informed of what had happened as quickly as possible before they could recover fully from their first reactions. The element of uncertainty was eliminated speedily when they learned there was no immediate possibility for a similar explosion to occur.



The men of military experience in South Amboy, as far as could be observed, reacted with decision and dispatch. After making sure that their own families were safe and accounted for, they donned their helmets and hurried to the City Hall for instructions. They wore their helmets for a two-fold purpose: protection and identification.

There seemed to be less personal confusion and shock among this segment of South Amboy's population. They had been schooled by experience and it appeared their first reaction was a call to duty. They accepted the situation as a challenge,

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attempting to meet it as each saw fit and according to the position in which each man happened to be at that time.

Two other reactions were observed. Many persons were sensitive to any extraordinary noises or sounds to which they were not accustomed. They were also likely to be more concerned over an injury or symptom of illness than they would have been under normal conditions.

When the explosion occurred, Mayor John B. Leonard of South Amboy, a merchant, was at home, relaxed, watching his television set. Mayor John J. Flynn, funeral home proprietor of Perth Amboy, was downtown with his family, talking to a friend who was congratulating him on his election to office on the previous Tuesday. When the explosion shook the area, Mayor Leonard hurried immediately to the City Hall to take command and Mayor Flynn rushed to police headquarters several blocks away from the municipal building where his office is located and took charge.

The off-duty police officers in both cities were recalled. Road blocks were set up to regulate traffic. The State Police, under the command of Colonel Charles H. Schoeffel, were alerted immediately and by 2300 hours 75 men were on duty. They took charge of the periphery of the area. The State Police force was reduced to 60 on Sunday and to 15 on Monday. There was no jurisdictional rivalry or competition between the state and the local police forces because Colonel Schoeffel worked directly with Mayor Leonard and Mayor Flynn.

The 114th Infantry Regiment of the National Guard, under the command of Colonel Walter Fetterly, was alerted at 2230 hours and by 2330 was on the scene. At the request of Mayor Leonard, Governor Alfred E. Driscoll did not declare the affected area under martial law, which would have placed the town under the control of military personnel. A "state of emergency" was ordered by the Governor which left civilian authorities in control, with the National Guard cooperating with the civilian authorities in preserving order. About 400 officers and enlisted men most of them from South Amboy, Perth Amboy, and the immediate vicinity, were on duty.

The Perth Amboy company was at its post and ready for action at 2030 hours but, because of the heavy telephone traffic, could not get orders to proceed until 2230 hours. The rapid mobilization of the National Guard was made possible through radio communication.

The National Guard units regulated traffic inside the cities and stood guard at

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the post offices, national banks, and other Federal property. Most of these troops were demobilized on Monday, 22 May 1950, except for twenty-five men retained for traffic duty. The troops were quartered at the Pennsylvania Railroad YMCA which also served as headquarters. Meals were served from field kitchens at the Harold S. Hoffman High School near the City Hall in South Amboy.

Colonel Harold V. Raycroft, of Ft. Monmouth, New Jersey, rushed to the scene with 150 troops and 50 military police with medical supplies and 1,000 blankets. These troops were removed before Sunday night but a company of military police was returned Monday evening to patrol the restricted area where the explosion occurred to prevent unauthorized persons from entering. A demolition squad was brought from Ft. Devens, Massachusetts, to clear the area of unexploded mines. The Coast Guard patrolled the coast to protect the area from approaches by water.

Quick action of the police and military personnel prevented looting. Not a single incident was reported.

Civilian relief agencies responded promptly. At the time of the catastrophe, representatives from ten chapters of the American Red Cross were holding a "disaster meeting" in East Orange, New Jersey. They were alerted at 2030 hours. At 2230 hours they were on the job in South Amboy. During the first two days about 400 meals were served by this organization. During the first two days 180 families asked for relief. By Monday contacts had been made with approximately 250 families.

The Metropolitan Life Insurance Company sent two public health nurses to assist the Red Cross. Twenty-three families were given shelter Friday night. There was no demand for shelter after the second day. The Red Cross avoids, as far as possible, mass shelter for disaster refugees because family disorganization usually occurs under such conditions.

By Saturday the Red Cross had perfected its organization to help local citizens rehabilitate their homes. On its order, building material dealers provided local citizens with roofing paper and other materials for temporary repairs.

The Salvation Army was also quickly on the job, rendering help wherever possible and serving coffee and doughnuts from its mobile canteen.

South Amboy was fortunate in that it had access to all the supplies it needed. Johnson and Johnson, one of the nation's largest manufacturers of medical supplies, has a plant only a few miles away and freely placed at the disposal of the Red Cross all the medical supplies it might need.

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*Left: Armed soldiers stood guard at a South Amboy postoffice during the night following the explosion.
—Photo by Wide World.*

Below: Unexploded in the midst of an explosion of 600 tons of munitions, the 60mm mortar shell at which Capt Hugh McCaffrey of the New Jersey National Guard is so cautiously probing was tossed into the building by the blast.

—Photo by Wide World.

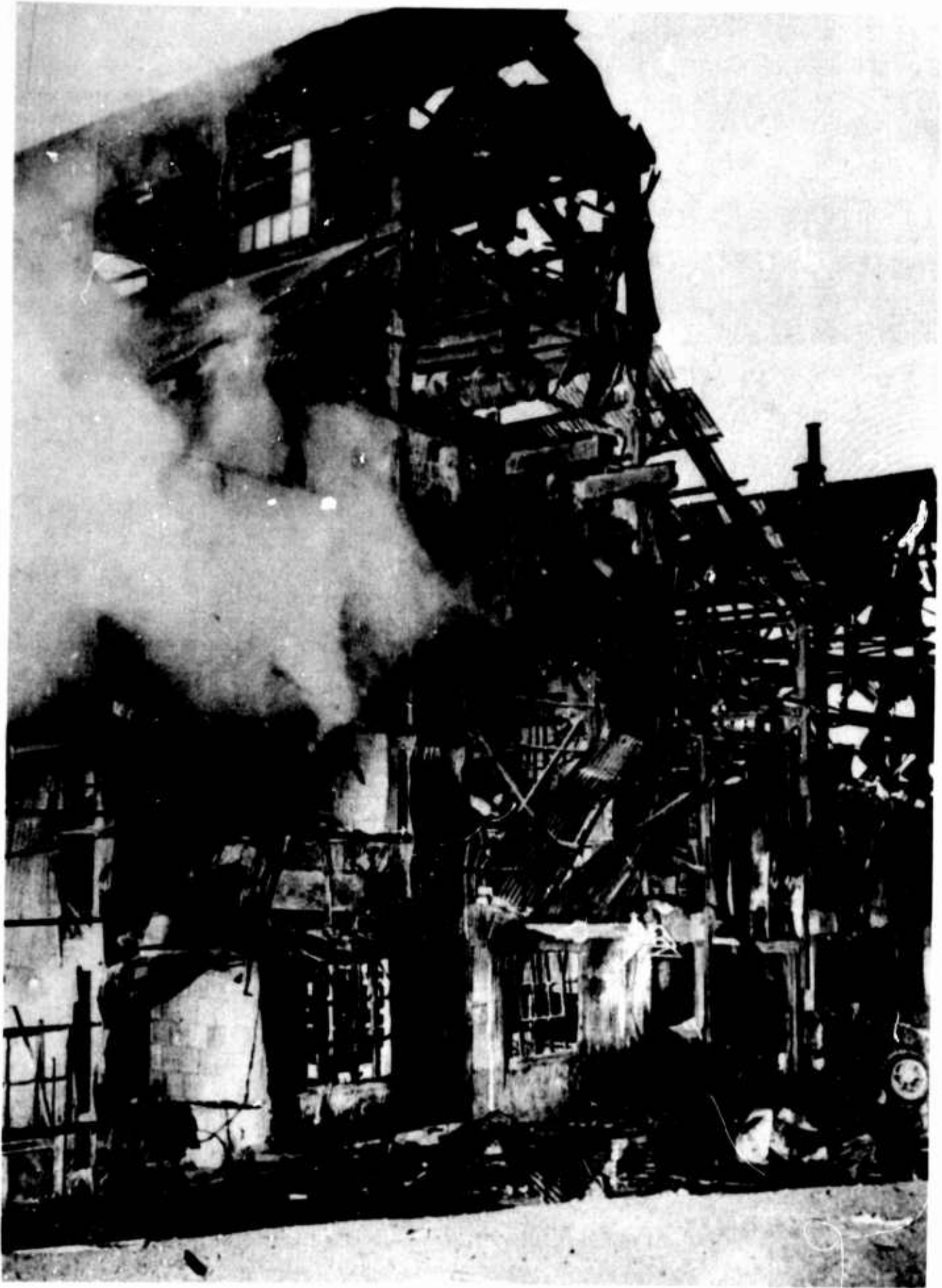


Above: Three miles from the scene of the blast, glass from shattered store windows littered the sidewalks in the heart of the Perth Amboy area.

—Photo by Wide World.



Above: Two miles from the blast, workmen clean up a shattered shoe store the day after the blast. —Photo by Wide World.

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Smoke rises from debris in the American Agricultural Chemical Company building wrecked near the dock area.—Photo by Wide World.

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Mayor Leonard of South Amboy appointed a "disaster committee" composed of two Roman Catholic clergymen, two Protestant clergymen, and three businessmen to direct the city's relief program. This committee also cooperated with the Red Cross in the program of rehabilitation. One of its main jobs was to pass on claims and applications from local citizens.

The New Jersey law prohibits municipalities from accepting financial gratuities from private sources. This committee was authorized by the Mayor to accept any funds offered in the name of the relief committee and not of the city. The committee had received approximately \$50,000. by Monday. Johnson and Johnson contributed \$25,000, and the National Lead Company \$5,000. The National Lead Company also offered, at its own expense, to replace the glass in all residences.

Public and parochial schools in South Amboy were damaged to such an extent that it was necessary to close the buildings for the remainder of the year; only 19 school days remained. This created a new problem because children were then at large in the town and interfered with the work of rehabilitation. There was also the fearful danger of their picking up unexploded mines. The New York Daily Mirror provided assistance in meeting this problem by arranging to take 300 children to Ebbett's Field on Tuesday, 300 on Wednesday, and 600 on Thursday. On Friday an additional 600 were taken to the Palisades Amusement Park. The trip was free to the children including admissions, hot dogs, pop, and ice cream cones.

Although Perth Amboy received considerable damage from the blast, it experienced less community disorganization than did South Amboy because the city was better prepared for such an emergency. As far back as 1939, two years before Pearl Harbor, it began making plans for defense and the officials were briefed on how to use them.

The 400 volunteer firemen in Perth Amboy, when they heard the alarm, went immediately to their assignments. The police were directed by radio to set up road blocks immediately.

The city has well defined places for evacuation if the need should arise. Further, the police prevented any looting in Perth Amboy. The business district, where the fronts were knocked out of numerous stores, was cleared immediately.

Particular note should be made by the military authorities of the behavior of local radio stations. Unless they are strictly controlled in similar emergencies, they can do more harm than good. They gave valuable assistance in mobilizing the National Guard. Some of the stations kept up a running comment on proceedings in

the area which served to keep the people informed but also excited them. As a result, they jammed the highways leading into the area to satisfy their curiosity, although some of them came because of concern over relatives.

But radio stations also rendered a disservice in calling for doctors, nurses, and fire equipment without authority. There were more of these who arrived on the scene than were needed. In South Amboy the out-of-town fire equipment, however, was located throughout the city at strategic places where the firemen connected hoses and remained alert until relieved.

A Standard of Disaster Evaluation

The explosion of an atomic bomb has three principal effects:

1. Physical damage from the blast;
2. Thermal damage from the intense heat of the explosion;
3. Radiological damage from the release of an enormous amount of high-energy radiation.

Personnel are vulnerable principally to the effects of thermal and high energy radiations and to the secondary effects from blast. Property is particularly vulnerable to blast and to the secondary effects of thermal radiation.

Total physical destruction from an atomic-bomb explosion of 20,000 tons TNT equivalent extends to about one mile. Flash burns from the intense heat of the explosion will cause immediate death to 50 percent of exposed personnel out to one and a half miles, will incapacitate 50 percent of those between one and a half and two miles, and can be tolerated only beyond three miles. The gamma radiation will cause death within four to six weeks to 50 percent of the people within two-thirds of a mile of the explosion, and from here to a mile out will produce radiation sickness in about 50 percent of those exposed—decrease in blood count, nausea, dizziness, fatigue -- but those so affected will recover with practically no lasting results greater than a decrease of a few months of life expectancy.

Physical damage is easily assessed. In the case of the South Amboy explosion complete destruction was limited to a radius of less than 800 feet in an area completely devoid of residences. While considerable damage and temporary inconvenience resulted, this was a minor affair compared with the damage and resulting fires produced by an atomic bomb.

Psychological damage, on the other hand, is not so easy to assess. Initially,

there was in South Amboy a period of less than an hour during which the people were frightened and bewildered, the period when panic and hysteria may develop. At first most people thought that the explosion had occurred on their own premises, but when they found their neighbors with the same opinions, they sought the facts and were thereby diverted from thinking of their own predicaments exclusively. And so the time of possible panic passed by, and the situation came quickly under the control of the authorities.

In both South Amboy and Perth Amboy, the use of sound trucks during this crucial period was very helpful. They are extremely effective, when manned by citizens of local prominence, in supplying information and instructions which are acceptable to the public. Their prompt use was undoubtedly of considerable importance in the rapid control of the situation^{2/}. In the event of an atomic attack, military authorities could use these means, too, to issue information and commands for the reorganization of units.

Prompt implementation of previously established "plans of defense" at the South Amboy area showed that these measures can be effective in the control of panic-producing situations. While these plans did not provide for disasters of the magnitude of those produced by atomic bombs, we believe that it is possible for any community to prepare itself for disasters of that scope by proper training.

There are some respects in which conditions in South Amboy might have been improved. While South Amboy and the surrounding communities had disaster organizations which were fairly satisfactory and apparently functioned promptly, there was no coordination among them. In this atomic age, when disaster areas are by nature extensive, it is likely that an entire community may be rendered helpless as the result of destruction of its equipment for public safety, as was the case in Hiroshima when 70 percent of its firemen and fire-fighting equipment were destroyed. Surrounding communities must come to the immediate aid of the stricken community. Unless there is an established plan for mutual assistance, panic may result.

For example, it is suggested that vulnerable areas be divided into sectors with the relief and public safety organizations of each particular community assigned the responsibility for one particular sector of each of its neighbors. Using prepared instructions, each group would know what to do when and if disaster strikes. Within

^{2/} The use of sound trucks should not be continued after the first day. People begin to resent the intrusion into privacy after the first shock of disaster has passed.

each sector, near the center, zones for control of conflagration and for other special assistance should be established as required under the direction of a radiological officer. Farther out from the center, first aid stations, evacuation squads, et cetera should operate. On the periphery of the zone, lines should be established for traffic blocks. The size and character of the sector would vary according to topography, land use, natural barriers, population density and other factors peculiar to the area in question. Alternate sectors should be defined depending on the location and kind of disaster.

To some extent the New Jersey State Police served as coordinators and did a fine job of blocking off the disaster area in record time, but they were not in sufficient force to assume control of the entire situation. The citizens were fortunate in having officials who were "natural leaders."

It appears, then, that disaster organizations should be representative of much larger districts in suburban areas, say counties, if they are to be effective in atomic attacks. Large urban areas can probably take care of themselves except in saturation atomic bombing.

Another lesson learned at South Amboy was that there must be complete control of communications and of traffic. Radio stations must not be allowed to broadcast unauthorized requests for doctors, nurses, et cetera, and sensational news of the happenings. They succeed only in jamming the roads with the curious and thus prevent necessary services from getting to the scene promptly.

There is general agreement among authorities that in the event of an atomic bomb explosion, it will not be possible to assemble enough medical assistance to take care of all the injured. Under the plan outlined above, together with training courses for self-help, this situation can be considerably improved.

Finally, we should consider the extrapolation that can be made from the South Amboy disaster to the behavior of military units. Although men carry into the Army the same set of emotions and mental processes that they had in civilian life, they represent a much more homogeneous group than a civilian community. The age group is restricted to mature individuals in their physical prime. They are away from their families and property and are, therefore, not subject to the anxieties which would arise if their loved ones or their personal possessions were involved. Those most likely to panic - the mentally and emotionally unstable - have been culled. One piece of evidence from South Amboy gives us an insight into the probable behavior of men who have had military training in disaster situations. After the first shock, we noted that ex-servicemen quickly reverted to a semblance of mili-

tary status. They donned helmets as substitutes for uniforms and reported immediately to the headquarters of established authority for assignment to duty.

Considerable study of various types of disasters will be needed before a Standard Operating Procedure for Atomic Warfare can be established. The South Amboy study was the first to be conducted with this end in view and adequate preparation for the investigation had not been formulated. We feel, though, that the results of the investigation have provided sufficient food for thought to make more fruitful investigations possible in the future.

Conclusions

1. The people living in the South Amboy area were conditioned to possible disasters.
2. Confusion and disorganization were lessened because of this conditioning.
3. Relief agencies, military and civilian, responded quickly and performed efficiently.
4. The community leaders met the emergency situation adequately.
5. The experience demonstrated the importance of control over communications systems and traffic in time of emergency.
6. Total war implies total defense. South Amboy showed that the military and civilian armies can cooperate to counteract the effects of disaster.